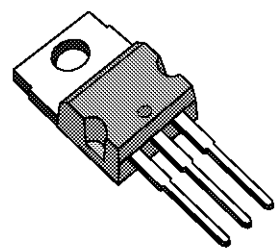
L7800AB/AC SERIES

PRECISION 1A REGULATORS

- OUTPUT CURRENT IN EXCESS OF 1A
- OUTPUT VOLTAGES OF 5; 6; 8; 9; 12; 15; 18; 24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR SOA PROTECTION
- 2% OUTPUT VOLTAGE TOLERANCE
- GUARANTEED IN EXTENDED TEMPERATURE RANGES

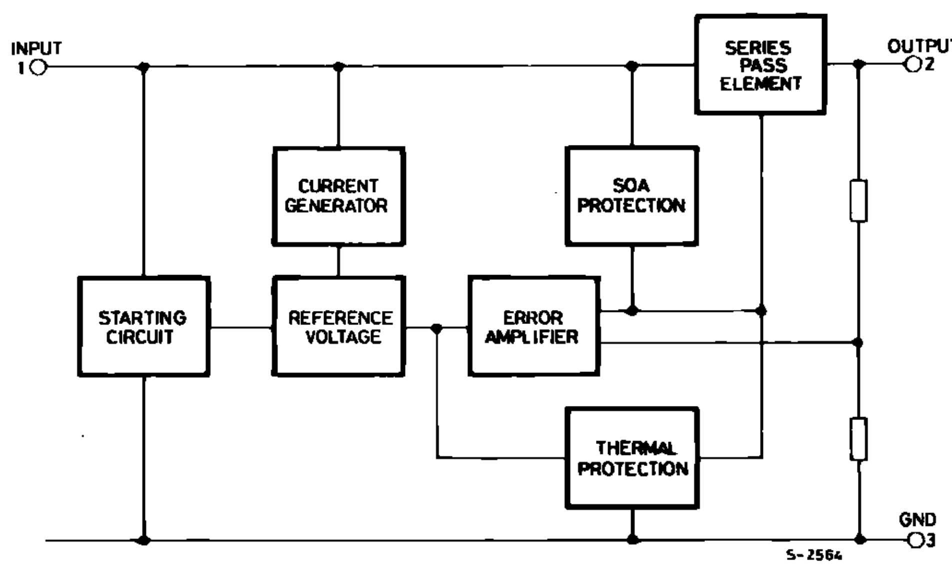


TO-220

DESCRIPTION

The L7800A series of three-terminal positive regulators is available in TO-220 and TO-3 packages and with several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

BLOCK DIAGRAM



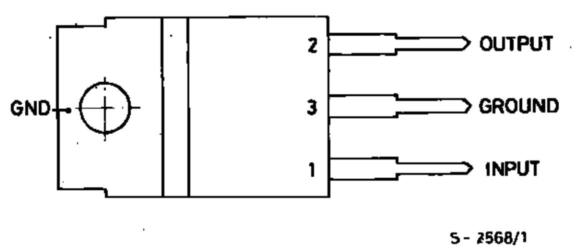
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_i	DC Input Voltage (for V_o = 5 to 18V) (for V_o = 24V)	35 40	V V
I_o	Output Current	Internally limited	
P_{tot}	Power Dissipation	Internally limited	
T_j	Operating Junction Temperature for L7800AC for L7800AB	0 to 125 – 40 to 125	°C °C
T_{stg}	Storage Temperature	– 65 to + 150	°C

THERMAL DATA

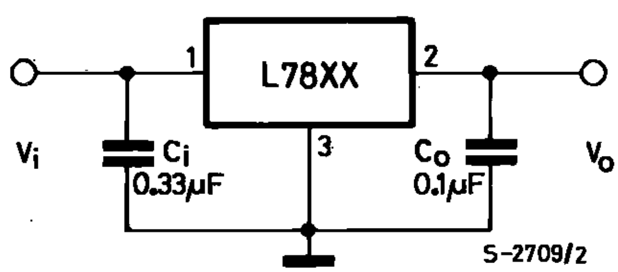
Symbol	Parameter		Value	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	3	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	50	°C/W

CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)

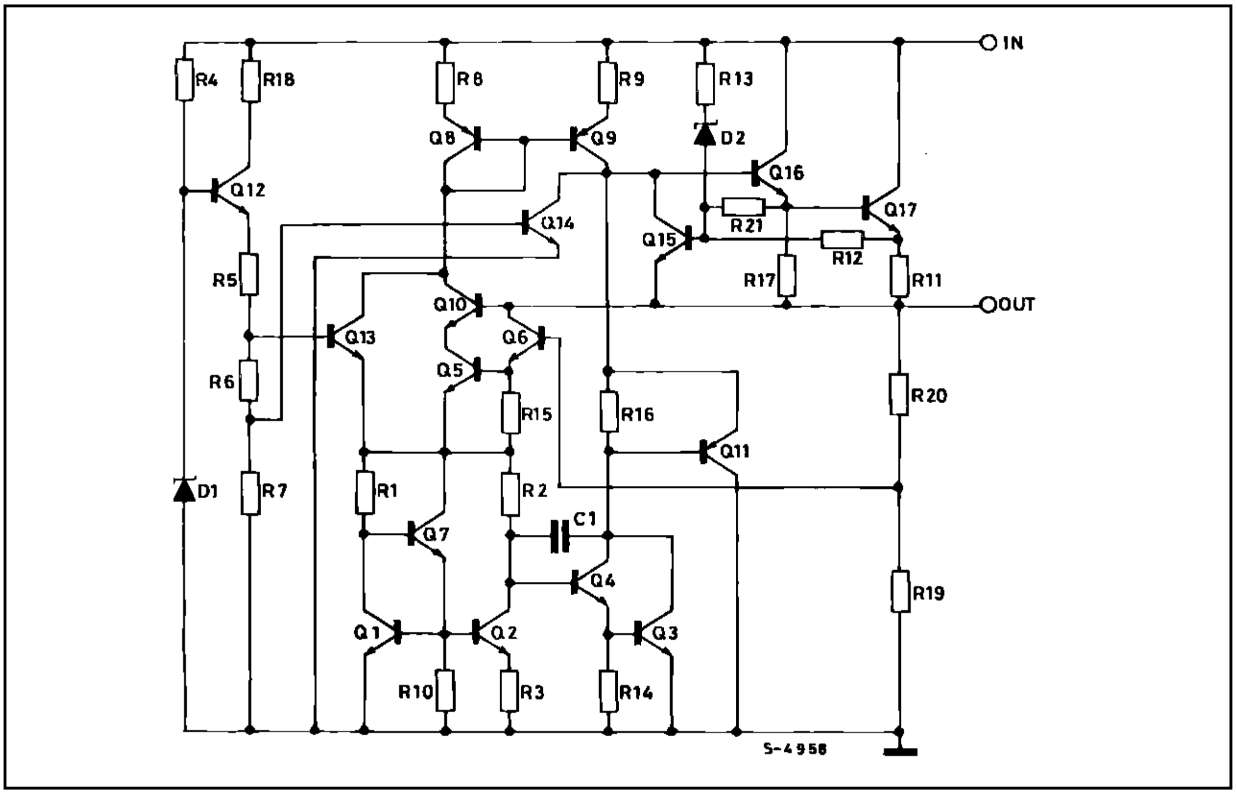


TO-220 (T_j = -40 to 125 °C)	TO-220 (T_j = 0 to 125 °C)	Output Voltage
L7805ABV	L7805ACV	5V
L7806ABV	L7806ACV	6V
L7808ABV	L7808ACV	8V
L7809ABV	L7809ACV	9V
L7812ABV	L7812ACV	12V
L7815ABV	L7815ACV	15V
L7818ABV	L7818ACV	18V
L7824ABV	L7824ACV	24V

TYPICAL APPLICATION



SCHEMATIC DIAGRAM



TEST CIRCUITS

Figure 1 : DC Parameters.

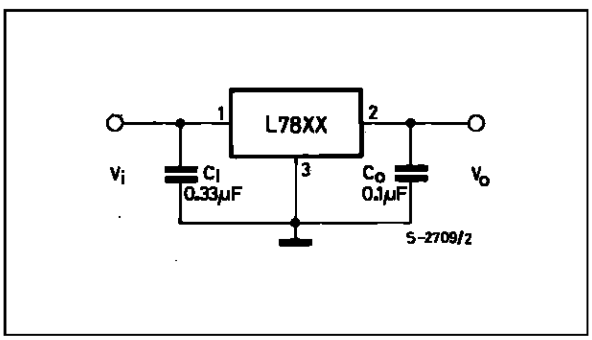


Figure 2 : Load Regulation.

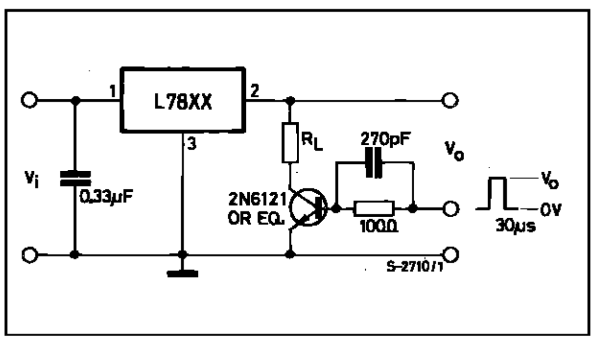
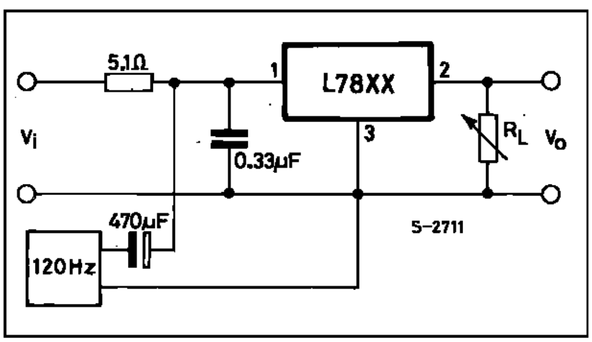


Figure 3 : Ripple Rejection.



ELECTRICAL CHARACTERISTICS FOR L7805A (V_i = 10V, I_o = 1 A, T_j = 0 to 125 ^oC (L7805AC), T_j = -40 to 125 ^oC (L7805AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	4.9	5	5.1	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 7.5 to 20 V	4.8	5	5.2	V
ΔV_o*	Line Regulation	V_i = 7.5 to 25 V I_o = 500 mA V_i = 8 to 12 V V_i = 8 to 12 V T_j = 25 ^oC V_i = 7.3 to 20 V T_j = 25 ^oC		7 10 2 7	50 5 25 50	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 8	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.3	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 8 to 25 V I_o = 500 mA V_i = 7.5 to 20 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 8 to 18 V f = 120 Hz I_o = 500 mA		68		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		17		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-1.1		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7806A (V_i = 11V, I_o = 1 A, T_j = 0 to 125 ^oC (L7806AC), T_j = -40 to 125 ^oC (L7806AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	5.88	6	6.12	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 8.6 to 21 V	5.76	6	6.24	V
ΔV_o*	Line Regulation	V_i = 8.6 to 25 V I_o = 500 mA V_i = 9 to 13 V V_i = 9 to 13 V T_j = 25 ^oC V_i = 8.3 to 21 V T_j = 25 ^oC		9 11 3 9	60 60 30 60	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.3	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 9 to 25 V I_o = 500 mA V_i = 8.6 to 21 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 9 to 19 V f = 120 Hz I_o = 500 mA		65		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		17		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-0.8		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7808A (V_i = 14V, I_o = 1 A, T_j = 0 to 125 ^oC (L7808AC), T_j = -40 to 125 ^oC (L7808AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	7.84	8	8.16	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 10.6 to 23 V	7.7	8	8.3	V
ΔV_o*	Line Regulation	V_i = 10.6 to 25 V I_o = 500 mA V_i = 11 to 17 V V_i = 11 to 17 V T_j = 25 ^oC V_i = 10.4 to 23 V T_j = 25 ^oC		12 15 5 12	80 80 40 80	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.3	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 11 to 25 V I_o = 500 mA V_i = 10.6 to 23 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 11.5 to 21.5 V f = 120 Hz I_o = 500 mA		62		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		18		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-0.8		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7809A (V_i = 15V, I_o = 1 A, T_j = 0 to 125 °C (L7809AC), T_j = -40 to 125 °C (L7809AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 °C	8.82	9	9.18	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 10.6 to 23 V	8.65	9	9.35	V
ΔV_o*	Line Regulation	V_i = 10.6 to 25 V I_o = 500 mA V_i = 11 to 17 V V_i = 11 to 17 V T_j = 25 °C V_i = 10.4 to 23 V T_j = 25 °C		12 15 5 12	90 90 45 90	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 °C I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 °C		4.3	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 11 to 25 V I_o = 500 mA V_i = 10.6 to 23 V T_j = 25 °C I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 11.5 to 21.5 V f = 120 Hz I_o = 500 mA		61		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 °C		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 °C		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		18		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 °C		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 °C		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-0.8		mV/°C

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7812A (V_i = 19V, I_o = 1 A, T_j = 0 to 125 ^oC (L7812AC), T_j = -40 to 125 ^oC (L7812AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	11.75	12	12.25	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 14.8 to 27 V	11.5	12	12.5	V
ΔV_o*	Line Regulation	V_i = 14.8 to 30 V I_o = 500 mA V_i = 16 to 22 V V_i = 16 to 22 V T_j = 25 ^oC V_i = 14.5 to 27 V T_j = 25 ^oC		13 16 6 13	120 120 60 120	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.4	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 15 to 30 V I_o = 500 mA V_i = 14.8 to 27 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 15 to 25 V f = 120 Hz I_o = 500 mA		60		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		18		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-1		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7815A (V_i = 23V, I_o = 1 A, T_j = 0 to 125 ^oC (L7815AC), T_j = -40 to 125 ^oC (L7815AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	14.7	15	15.3	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 17.9 to 30 V	14.4	15	15.6	V
ΔV_o*	Line Regulation	V_i = 17.9 to 30 V I_o = 500 mA V_i = 20 to 26 V V_i = 20 to 26 V T_j = 25 ^oC V_i = 17.5 to 30 V T_j = 25 ^oC		13 16 6 13	150 150 75 150	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.4	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 17.5 to 30 V I_o = 500 mA V_i = 17.5 to 30 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 18.5 to 28.5 V f = 120 Hz I_o = 500 mA		58		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		19		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-1		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7818A (V_i = 27V, I_o = 1 A, T_j = 0 to 125 ^oC (L7818AC), T_j = -40 to 125 ^oC (L7818AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	17.64	18	18.36	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 21 to 33 V	17.3	18	18.7	V
ΔV_o*	Line Regulation	V_i = 21 to 33 V I_o = 500 mA V_i = 24 to 30 V V_i = 24 to 30 V T_j = 25 ^oC V_i = 20.6 to 33 V T_j = 25 ^oC		25 28 10 5	180 180 90 180	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.5	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 21 to 33 V I_o = 500 mA V_i = 21 to 33 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 22 to 32 V f = 120 Hz I_o = 500 mA		57		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		19		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-1		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS FOR L7824A (V_i = 33V, I_o = 1 A, T_j = 0 to 125 ^oC (L7824AC), T_j = -40 to 125 ^oC (L7824AB) unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	T_j = 25 ^oC	23.5	24	24.5	V
V_o	Output Voltage	I_o = 5 mA to 1 A $P_o \leq$ 15 W V_i = 27.3 to 38 V	23	24	25	V
ΔV_o*	Line Regulation	V_i = 27 to 38 V I_o = 500 mA V_i = 30 to 36 V V_i = 30 to 36 V T_j = 25 ^oC V_i = 26.7 to 38 V T_j = 25 ^oC		31 35 14 31	240 240 120 240	mV mV mV mV
ΔV_o*	Load Regulation	I_o = 5 mA to 1 A I_o = 5 mA to 1.5 A T_j = 25 ^oC I_o = 250 to 750 mA		25 30 10	100 100 50	mV mV mV
I_d	Quiescent Current	T_j = 25 ^oC		4.6	6 6	mA
ΔI_d	Quiescent Current Change	V_i = 27.3 to 38 V I_o = 500 mA V_i = 27.3 to 38 V T_j = 25 ^oC I_o = 5 mA to 1 A			0.8 0.8 0.5	mA mA mA
SVR	Supply Voltage Rejection	V_i = 28 to 38 V f = 120 Hz I_o = 500 mA		54		dB
V_d	Dropout Voltage	I_o = 1 A T_j = 25 ^oC		2		V
e_N	Output Noise Voltage	B = 10Hz to 100KHz T_j = 25 ^oC		10		$\mu V/V_o$
R_o	Output Resistance	f = 1KHz		20		mΩ
I_{sc}	Short Circuit Current	V_i = 35 V T_{amb} = 25 ^oC		0.2		A
I_{scp}	Short Circuit Peack Current	T_j = 25 ^oC		2.2		A
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			-1.5		mV/^oC

* Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

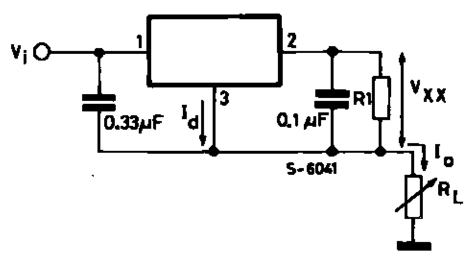
APPLICATIONS INFORMATION

DESIGN CONSIDERATIONS

The L7800A Series of fixed voltage regulators are designed with Thermal Overload Protection that shuts down the circuit when subjected to an excessive power overload condition, Internal Short-circuit Protection that limits the maximum current the circuit will pass, and Output Transistor Safe-Area Compensation that reduces the output short-circuit current as the voltage across the pass transistor is increased.

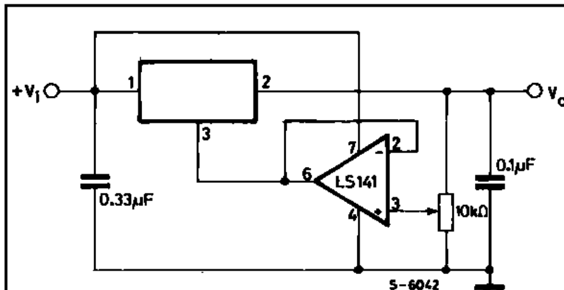
In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire lengths, or if the output load capacitance is large. An input bypass capacitor should be selected to provide good high-frequency characteristics to insure stable operation under all load conditions. A 0.33µF or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead.

Figure 4 : Current Regulator.



$$I_O = \frac{V_{XX}}{R1} + I_d$$

Figure 5 : Adjustable Output Regulator.

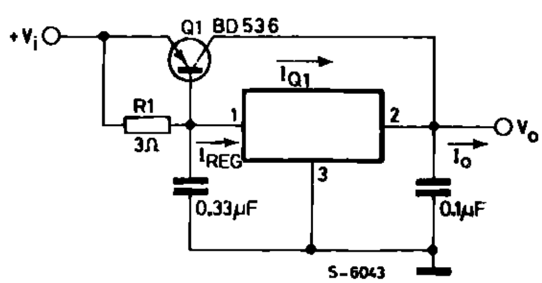


V_O, 7.0V to 20V

$V_i - V_O \geq 2.0V$

The addition of an operational amplifier allows adjustment to higher or intermediate values while retaining regulation characteristics. The minimum voltage obtainable with this arrangement is 2.0V greater than the regulator voltage.

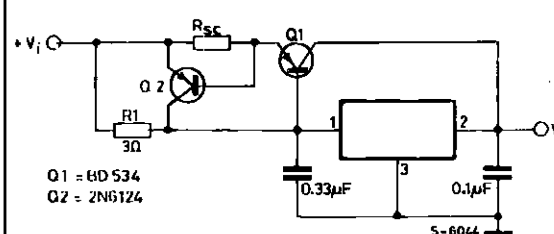
Figure 6 : Current Boost Regulator.



$$R_1 = \frac{V_{BEQ1}}{I_{REG} - \frac{I_{Q1}}{\beta_{Q1}}}$$

$$I_o = I_{REG} + \beta_{Q1} \left[I_{REG} - \frac{V_{BEQ1}}{R_1} \right]$$

Figure 7 : Short-circuit Protection.



The circuit of figure 6 can be modified to provide supply protection against short circuit by adding a short-circuit sense resistor, R_{SC}, and an additional PNP transistor. The current sensing PNP must be able to handle the short-circuit current of the three-terminal regulator. Therefore, a four-ampere plastic power transistor is specified.

TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.2		15.9	0.598		0.625
L7	6.2		6.6	0.244		0.260
L9	3.5		4.2	0.137		0.165
DIA.	3.75		3.85	0.147		0.151

